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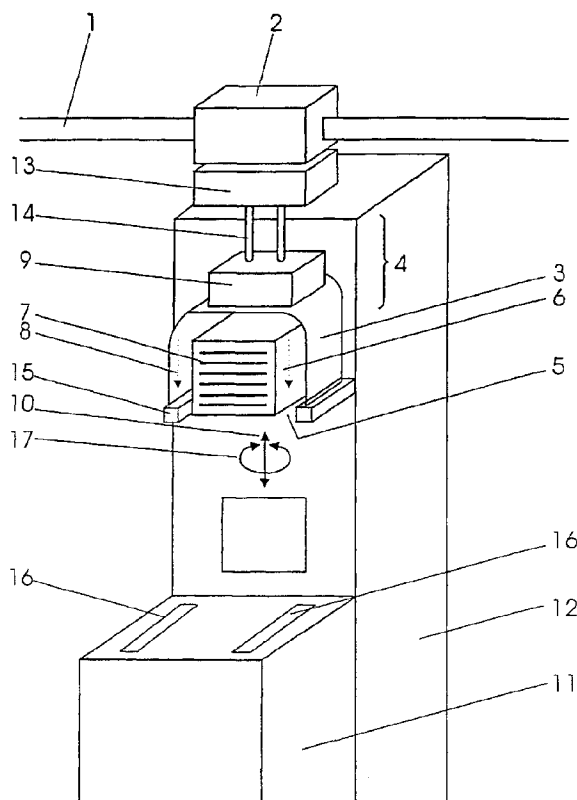
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(54) Title: **OVERHEAD TRANSPORT SYSTEM FOR OPEN CASSETTE TRANSPORT**



(57) Abstract: The invention concerns an overhead transport system which is applicable for open cassette carriers. The invention comprises a hood (3) with an open bottom (5) connected to the transport vehicle (2) at a hanging manner so that the hood (3) is guided below the rail (1), an open wafer carrier (6) design for storing wafers (7) arranged within the liftable hood (3), and a mini-environment within the hood (3) to prevent the wafers (7) stored within the open wafer carrier (6) from particle contamination. The mini-environment is realized with an air stream from an air filter (9) at the top of the hood (3).

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## DESCRIPTION

## 5 OVERHEAD TRANSPORT SYSTEM FOR OPEN CASSETTE TRANSPORT

The present invention relates to an overhead transport system for open cassette transport with a rail mounted or secured at the top or at the ceiling of a space with transport vehicles  
10 guided by the rail and driven along the rail by a suitable drive system to transport wafers to several treatment tools.

Well known overhead transport systems are usable only for closed cassettes with the wafers stored at the clean inside.  
15 This is due to the reason that such transport systems provide only class 100 cleanliness or if class 1 or lower are not recommended to transport open cassettes because of contamination concerns. Therefore, the known overhead transport systems work only for SMIF-(Standard Mechanical Interface) or FOUP  
20 (Front Opening Unified Pod)-containers. One example for a FOUP-transporting cassette is described in DE 197 31 174 A1.

The transport of open cassettes without any box or container requires floorbased vehicles to ensure clean transport without contamination of the wafers stored within the cassette.  
25 Floorbased transport systems ensure that the source of particle contamination stays below the area where the cassette is located during the transport.

30 One of such a floorbased transport system is known from DE 43 09 092 C2. This transport system according to the described embodiment in the document covers a chamber with the clean room class 1 or 0,1 with a rail within the chamber. The

2

rail defines storing places for carriers with wafers stored within the carrier at a vertical alignment. The transport of the carrier is carried out by way of a lift mounted on a x-y-sledge.

5

Such a transport system is very expensive in manufacturing and can produce a particle contamination within the chamber. Therefore, the chamber is connected to an exhaust system for maintaining the clean room conditions.

10

Another new transport system uses the space over the ceiling of the clean room i.e. the mezzanine. In this embodiment the whole carrier storage and transport system is placed in this space. A robot arm transports the selected carrier (FOUP-

15 Carrier) from the storage position to a lift device to transport the carrier down through a floodgate to a loadport of a treatment tool. The carrier must be of a closed type.

The described transport system is effective, but the installation is very expensive in cost and manufacturing.

20

#### SUMMARY OF THE INVENTION

It is an object of the present invention to provide an overhead transport system which is applicable for open cassette carriers without need of any additional box or casing to improve the handling of the wafers stored on the cassette carrier, which system improves the safety of the handling personnel.

30

Another object of the present invention is to provide an overhead transport system especially applicable for 300 mm wafers and which is easy to handle.

A further object of the present invention is to reduce the cost for the transport system.

5 In accordance with one object of the invention there is provided an overhead transport system for open cassette transport with rails mounted at the top or at the ceiling of a space and with transport vehicles guided by the rail and driven by a suitable drive system to transport wafers, comprising a hood with an open bottom connected to the transport  
10 vehicle in a hanging manner so that the hood is guided beneath the rail, an open wafer carrier for storing wafers arranged within the hood, a minienvironment within the hood to prevent the wafers stored within the open wafer carrier from  
15 particle contamination, and a loadport of a wafer treatment tool, whereby the hood has a light reflector element at its bottom which corresponds to a light source arranged at the loadport.

20 Preferably, the loadport contains a light source to correspond with the light reflector element at the open bottom of the hood.

This aspect of the invention ensures a proper positioning of  
25 the hood in relation to the loadport and the security for the serving personnel is improved since the lift can be stopped if the light reflector does not receive the light from the light source. This case can happen if for instance the serving personnel has a hand or another part of the body between  
30 the hood and the loadport.

This solution ensures that particles produced by the overhead transport system or other moved systems, even if class 1 or

less is to be maintained, are separated from the transport load i.e. the open wafer carrier with the wafers stored on board.

- 5 Therefore a slight air stream is to be realized from the top to the bottom of the interior of the hood.

Furthermore the hood contains an electrostatic air filter at the top, which enables proper maintenance to ensure always  
10 clean hood conditions.

As an alternative the hood contains a mechanical air filter at the top, which enables also a proper control of the mini-environment to ensure always clean hood conditions.

15

A further aspect of the invention is that the hood always stays with the vehicle and that the connecting elements are provided with a lifting device suitable to lift the hood down to a loadport of a treatment tool to unload/load wafers or to  
20 lift the hood after load/unload of the wafers.

As an alternative the hood is provided with a lifting device to lift the open wafer carrier down to a loadport of a treatment tool or up whereby the hood stays at the transport vehicle.  
25

Preferably, the hood has an angle adjustment capability to ensure that the open wafer carrier is handled during transport at a given angle compared to the horizontal. This angle  
30 should be between 5 - 10 degrees. This embodiment ensures the wafers from falling out of the open wafer carrier during transport or by shocks.

5

To prevent the loadport and the hood with the open wafer carrier from any contamination it is preferred that a downwardly directed air stream is realized at the front of the treatment tool enclosing the loadport. This air stream should be a laminar air stream.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The enclosed drawing shows schematically an embodiment of the invention with an overhead transport system for open wafer carriers.

#### DETAILED DESCRIPTION OF THE INVENTION

15 The overhead transport system according to the invention consists of a rail 1 mounted at the top or at the ceiling of a space or room. This space is within a cleanroom of a semiconductor wafer manufacturing facility. On this rail 1 a transport vehicle 2 is guided and driven by a not shown drive system. Such a drive system can be realized by an active system with well known driven ball bearings, by a linear step motor drive or by another electric motor drive.

25 With this transport vehicle 2 is connected a hood 3 in such a manner that the hood 3 is hanging below the rail 1 and the transport vehicle 2. The hood 3 follows the movement of the transport vehicle 2 which is secured and guided on the rail 1.

30 As seen from the drawing the hood 3 is connected to the transport vehicle 2 via connecting elements 4 and is provided with an interior with an open bottom 5. Within the interior an open wafer carrier 6 is secured to store and transport wa-

6

fers 7. The open wafer carrier 6 has a "mushroom" interface to be handled as a FOUP for 300 mm semiconductor wafers (FOUP: Front Opening Unified Pod).

- 5 The hood 3 has an angle adjustment capability to ensure that the open wafer carrier 6 is handled during transport at a angle between 5 - 10 degrees. This embodiment ensures, that the wafers 7 do not fall out of the wafer carrier 6 during transport or by shocks.

10

Within the hood 3 is realized a minienvironment to prevent the wafers 7 from particle contamination. For this reason within the hood 3 is realized an slight air stream 8 from the top to the open bottom 5 of the hood 3. To clean the air to  
15 the necessary clean room class contains the hood 3 an electrostatic or mechanical air filter 9.

The hood 3 and the open wafer carrier 6 are vertically liftable along an up/down direction (indicated with arrow 10) from  
20 the transport vehicle 2 to a loadport 11 of a treatment tool 12 and vice versa. Therefore, the connecting element 4 is provided with a lifting device 13. This lifting device 13 has a not shown drive motor and cables 14 on which the hood 3 is secured. The lifting device 13 also can be provided with a  
25 turning element which can turn the hood 3 around a vertical axis (indicated with arrow 17) so that it is possible to move the hood 3 at such a position that the wafers 7 can be transferred into the treatment tool 12. This is helpful when several treatment tools 12 are arranged at an angle of 90 degrees to each other.  
30

Furthermore the hood 3 contains at the open bottom 5 of it a light reflector element 15 which corresponds with a light

source 16 on the loadport 11. Thus a proper positioning of the hood 3 in relation to the loadport 11 is ensured and the safety for the serving personnel or the operators is improved since the lifting device can stop if the light reflector element 15 does not receive the light from the light source 16. This case can happen if for instance the serving personnel has a hand or another part of the body between the hood 3 and the loadport 11.

- 10 To ensure that not any contamination happens at the area of the loadport a downwardly directed air stream is realized at the front of the treatment tool 12 enclosing the loadport 11. This air stream is preferably a laminar air stream.



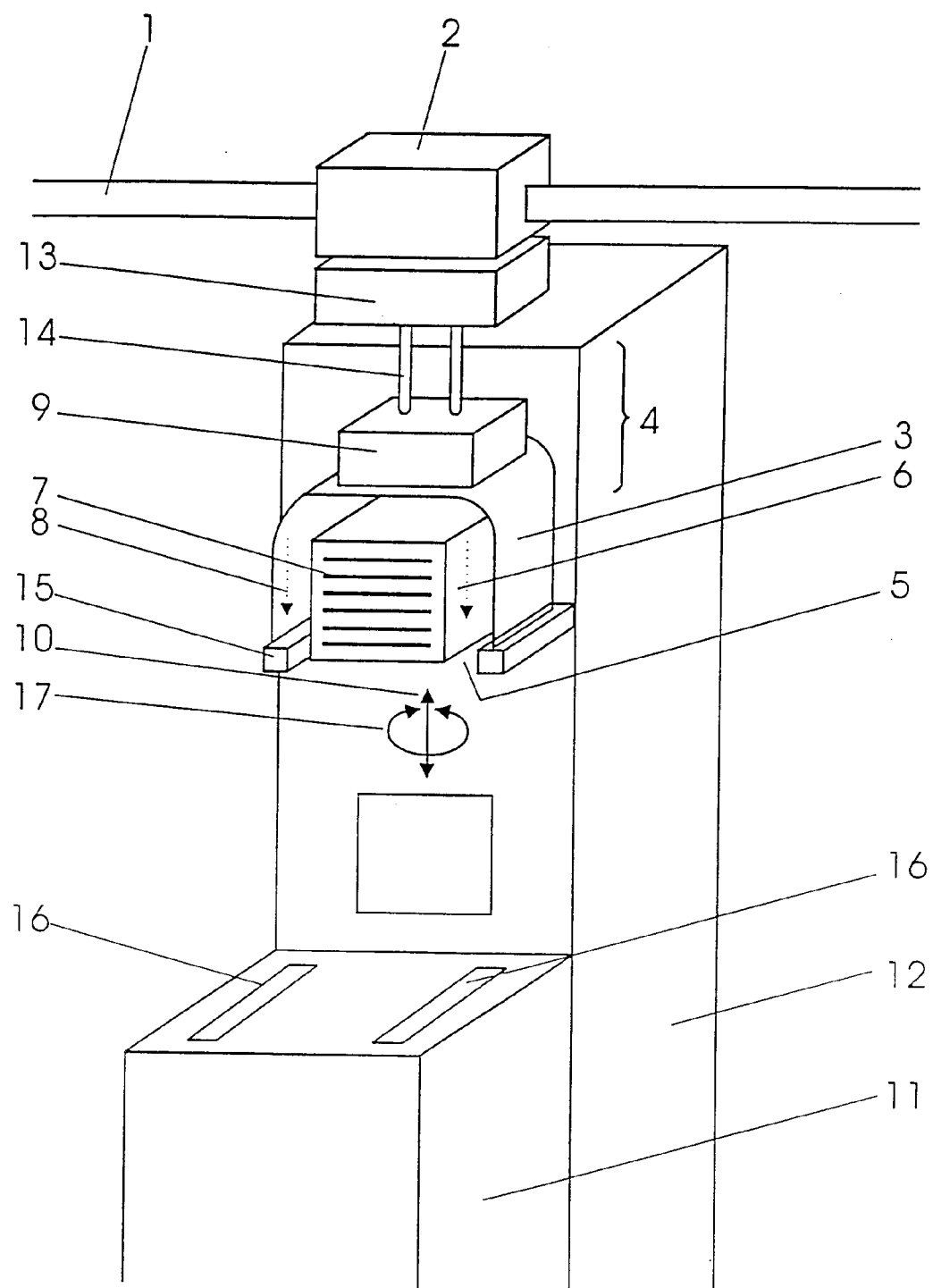
## CLAIMS

1. An overhead transport system for open cassette transport  
5 with rails mounted at the top or at the ceiling of a space and with transport vehicles guided by the rail and driven by a suitable drive system to transport wafers, comprising
- 10 a) a hood (3) with an open bottom (5) connected to the transport vehicle (2) in a hanging manner so that the hood (3) is guided beneath the rail (1),
- b) an open wafer carrier (6) for storing wafers (7) arranged within the hood (3),  
15
- c) a minienvironment within the hood (3) to prevent the wafers (7) stored within the open wafer carrier (6) from particle contamination, and  
20
- d) a loadport (11) of a wafer treatment tool (12), whereby the hood (3) has a light reflector element (15) at its bottom which corresponds to a light source (16) arranged at the loadport (11).  
25
2. An overhead transport system according to claim 1, wherein an air stream (8) is realized from the top to the open bottom (5) within the interior of the hood (3).
- 30 3. An overhead transport system according to claim 1 or 2, wherein the hood (3) contains an air filter (9) on the top, which enables proper control of the minienvironment

within the hood (3) to ensure always clean hood conditions.

4. An overhead transport system according to claim 3,  
5 wherein the air filter (9) is of an electrostatic type.
5. An overhead transport system according to claim 3,  
wherein the air filter (9) is of a mechanical type.
- 10 6. An overhead transport system according to claims 1 to 5,  
wherein the hood (3) always stays with the transport vehicle (2).
7. An overhead transport system according to anyone of the  
15 claims 1 to 6, wherein connecting elements (4) are provided with a lifting device (13), the connecting elements (4) being suitable to lift the hood (3) down to a loadport (11) of a treatment tool (12) to unload or load the wafers (7) or to lift back the hood (3) to the transport vehicle (2) after unload or load of the wafers (7).  
20
8. An overhead transport system according to anyone of the claims 1 to 6, wherein within the hood (3) a lifting device to lift the open wafer carrier (6) down to a  
25 loadport (11) of a treatment tool (12) or up into the hood (3) is installed whereby the hood (3) stays at the transport vehicle (2).
9. An overhead transport system according to anyone of the  
30 claims 1 to 8, wherein the hood (3) has an angle adjustment capability to ensure that the open wafer carrier (6) is handled during transport at a given angle position with respect to the horizontal.

10. An overhead transport system according to claim 8,  
wherein the given angle is between 5 - 10 degrees.
- 5 11. An overhead transport system according to anyone of the  
claims 1 to 10, wherein the loadport (11) contains a  
light source (16) to correspond with the light reflector  
element (15) at the open bottom (5) of the hood (3).
- 10 12. An overhead transport system according to anyone of the  
claims 1 to 11, whereby a downward directed air stream is  
realized at the front of the treatment tool (12) enclosing  
the loadport (11).
- 15 13. An overhead transport system according to claim 12,  
wherein the air stream is a laminar air stream.



# INTERNATIONAL SEARCH REPORT

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**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 H01L21/00

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	PATENT ABSTRACTS OF JAPAN vol. 017, no. 356 (E-1394), 6 July 1993 (1993-07-06) -& JP 05 055350 A (MURATA MACH LTD), 5 March 1993 (1993-03-05) abstract	1-3,6,11
A	---	7,8
Y	PATENT ABSTRACTS OF JAPAN vol. 1999, no. 04, 30 April 1999 (1999-04-30) -& JP 11 024750 A (SHINKO ELECTRIC CO LTD), 29 January 1999 (1999-01-29) abstract  --- -/--	1-3,6,11



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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# INTERNATIONAL SEARCH REPORT

International Application No

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>DATABASE WPI  Section PQ, Week 199639  Derwent Publications Ltd., London, GB;  Class P56, AN 1996-388417  XP002129774  -&amp; JP 08 188375 A (TSUBAKIMOTO CHAIN CO),  23 July 1996 (1996-07-23)  abstract</p>	1,9,10
A	<p>WO 98 58402 A (APPLIED MATERIALS)  23 December 1998 (1998-12-23)  abstract</p>	1

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Information on patent family members

International Application No

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JP 11024750 A	29-01-1999	US 6019563 A	01-02-2000
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WO 9858402 A	23-12-1998	NONE	